US009437982B2

(12) **United States Patent**
Wu et al.

(10) **Patent No.: US 9,437,982 B2**
(45) **Date of Patent: Sep. 6, 2016**

(54) **CABLE CONNECTOR ASSEMBLY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/458,178**

(22) Filed: **Aug. 12, 2014**

(65) **Prior Publication Data**

US 2015/0044911 A1 Feb. 12, 2015

(30) **Foreign Application Priority Data**

Aug. 12, 2013 (CN) 2013 1 0347650

(51) **Int. Cl.**
H01R 13/66 (2006.01)
H01R 43/20 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/665*** (2013.01); ***H01R 43/20*** (2013.01); *Y10T 29/49174* (2015.01)

(58) **Field of Classification Search**
CPC H01R 13/665; H01R 43/20; H01R 13/6658; H01R 13/6466; H01R 13/6467
USPC 439/620.22, 620, 620.06, 620.15, 439/620.21, 620.241, 620.2
See application file for complete search history.

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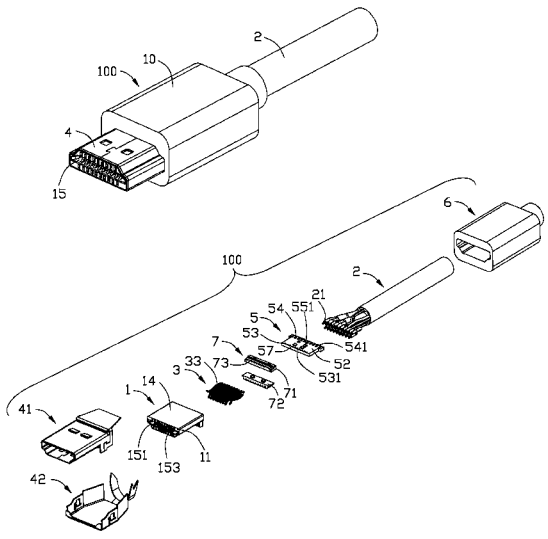
(57) **ABSTRACT**

A cable connector assembly includes a connector comprising an insulative body, a number of conductive terminals received in the insulative body, and a printed circuit board (PCB) electrically connected with the conductive terminals; a cable having a plurality of core wires; and a number of electronic components disposed on the PCB. The insulative body includes a front face and a rear face opposite to the front face. The PCB has a front portion electrically connected with the conductive terminals, a rear portion electrically connected with the core wires, and a middle portion connecting the front portion and the rear portion. The rear portion has a number of first pads electrically connected with the core wires. The front portion and the middle portion are disposed in the insulative body and the rear portion is disposed outside of the insulative body.

10 Claims, 6 Drawing Sheets



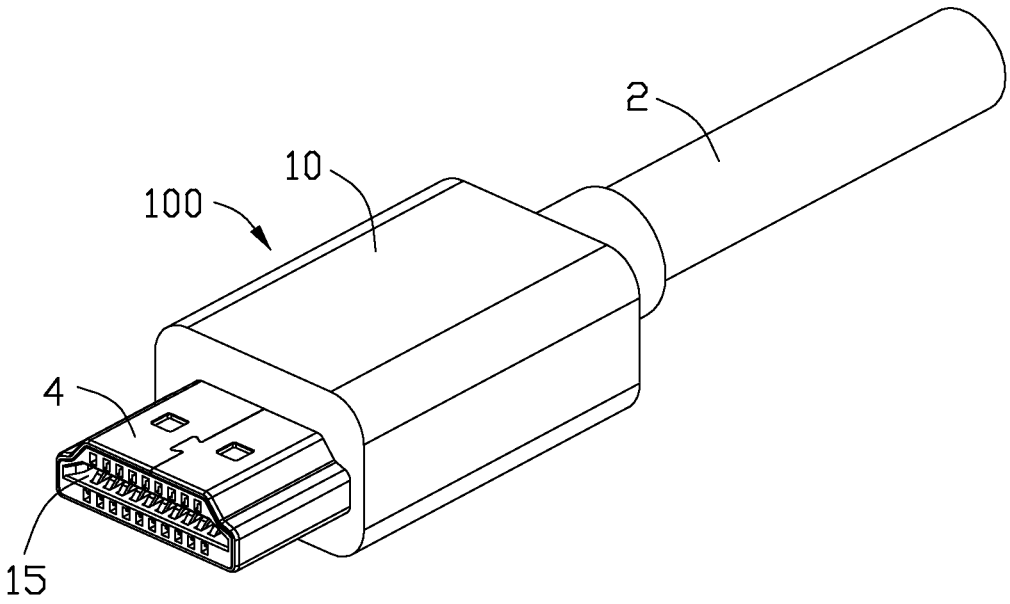


FIG. 1

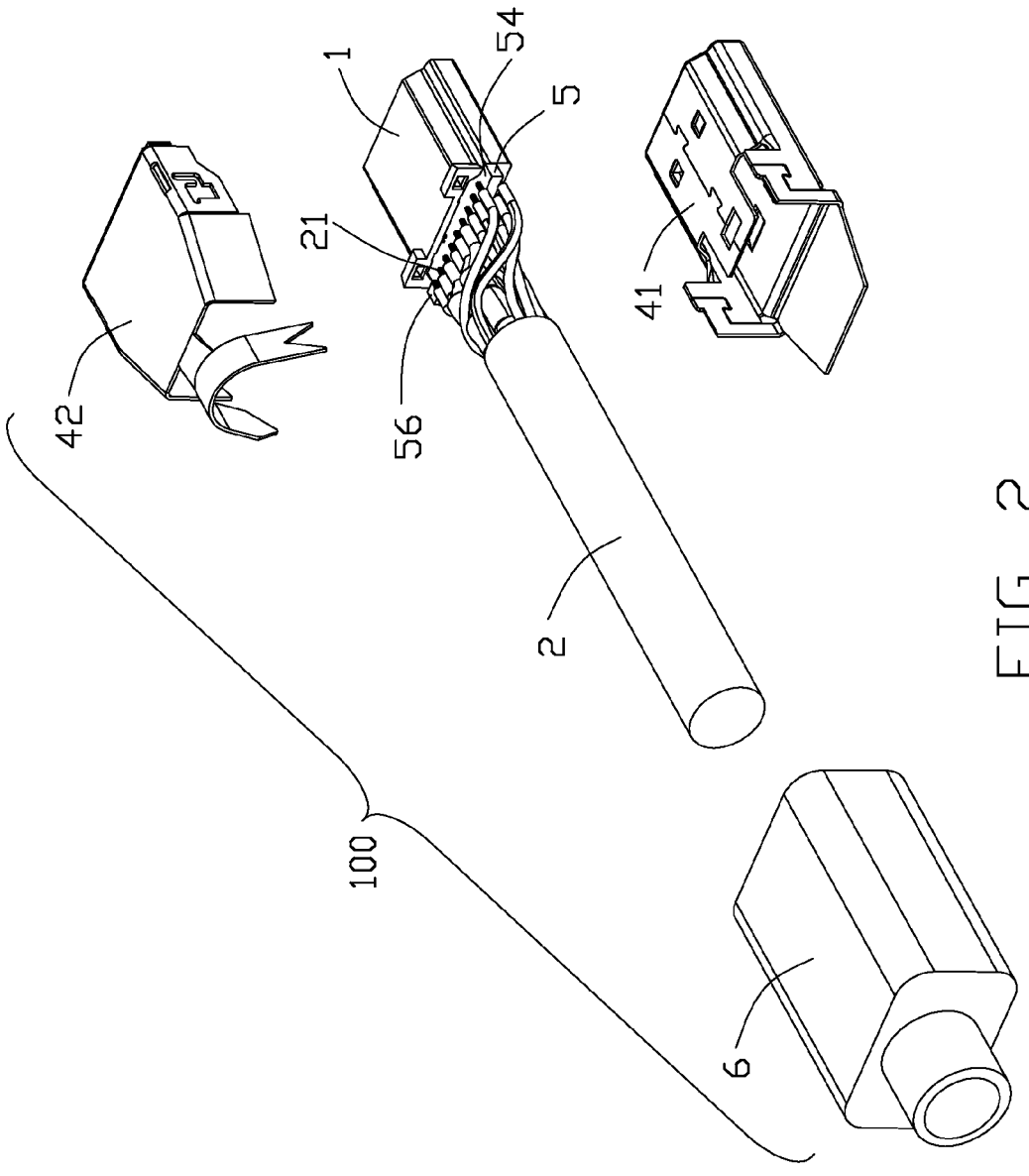


FIG. 2

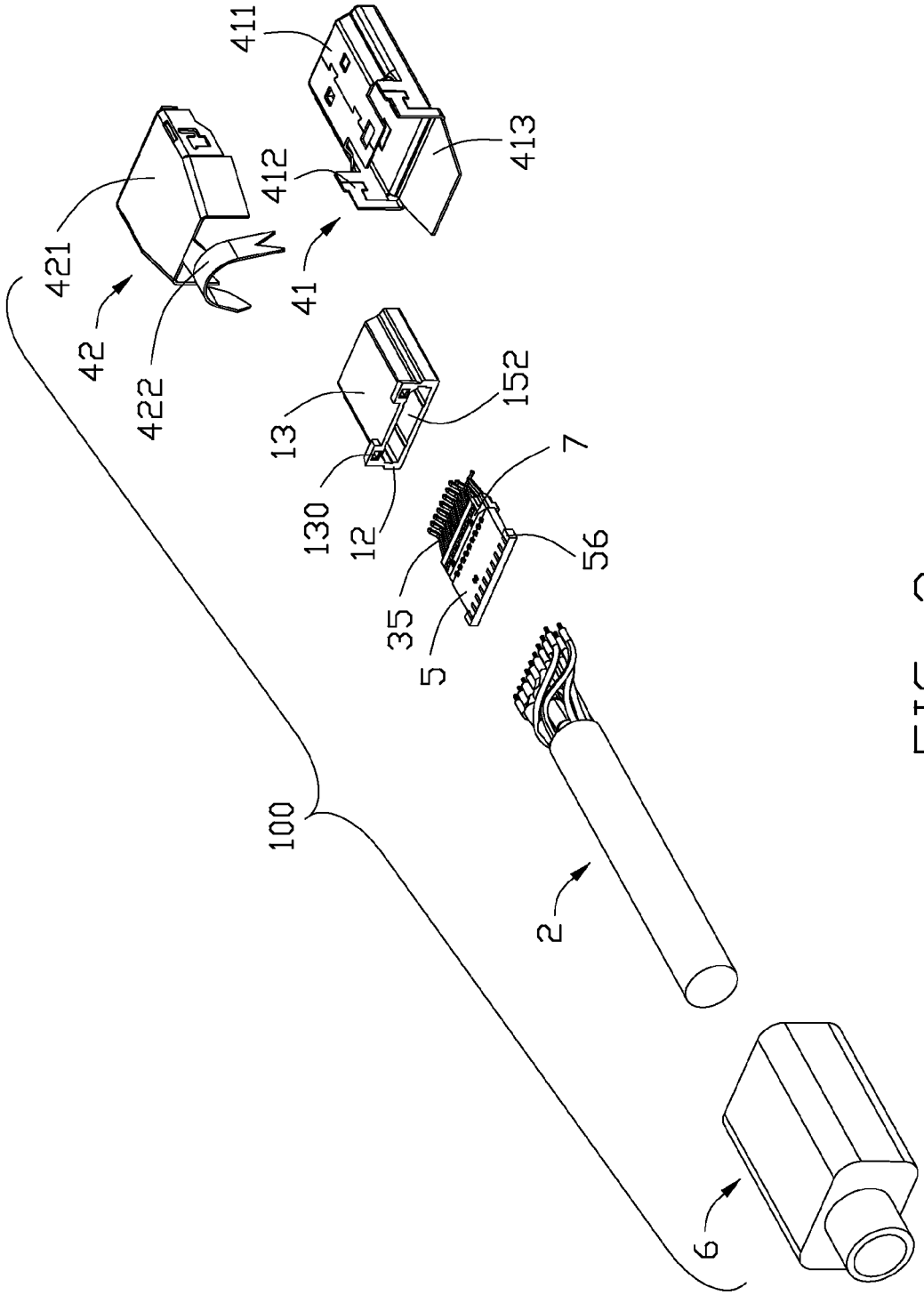


FIG. 3

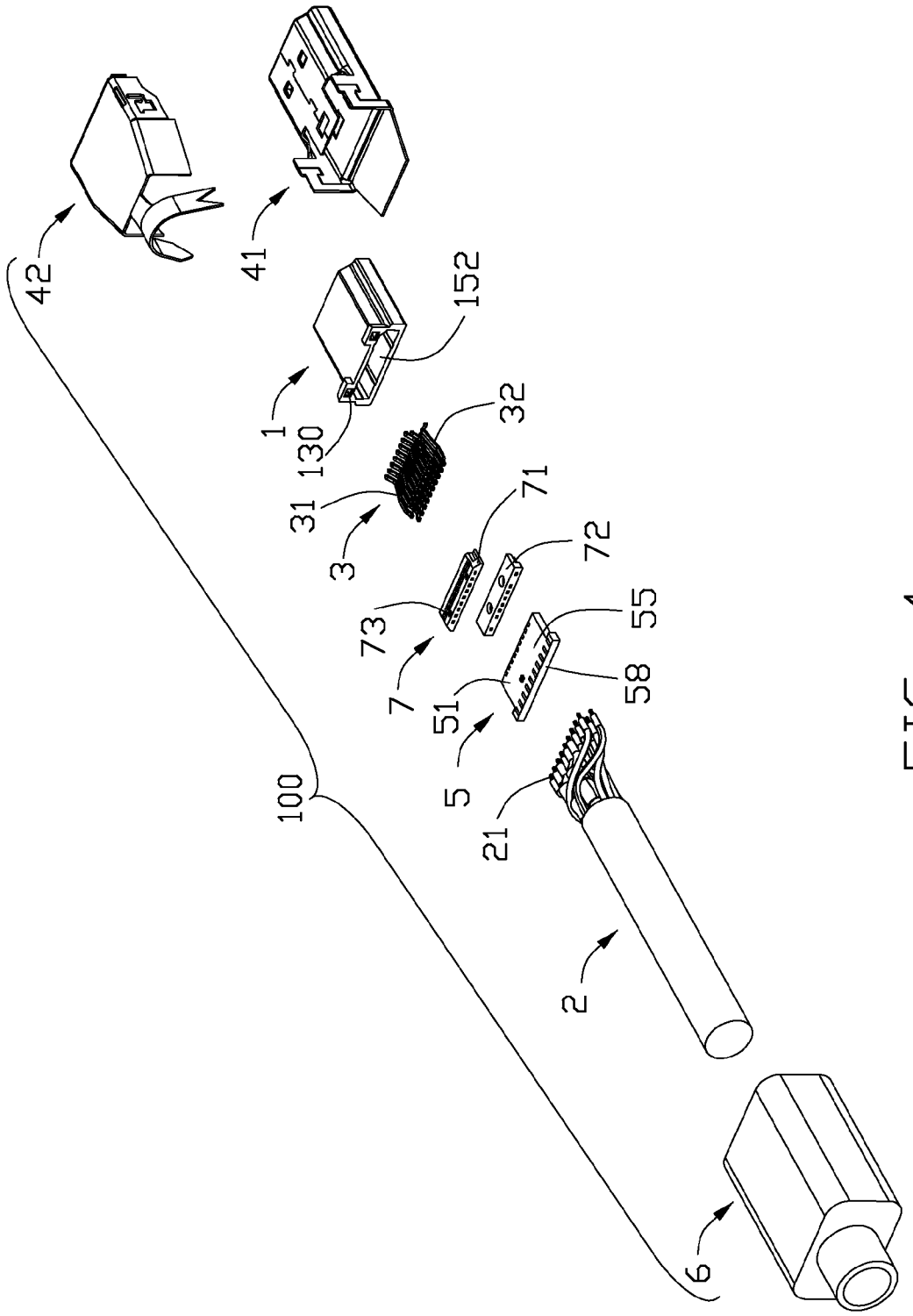


FIG. 4

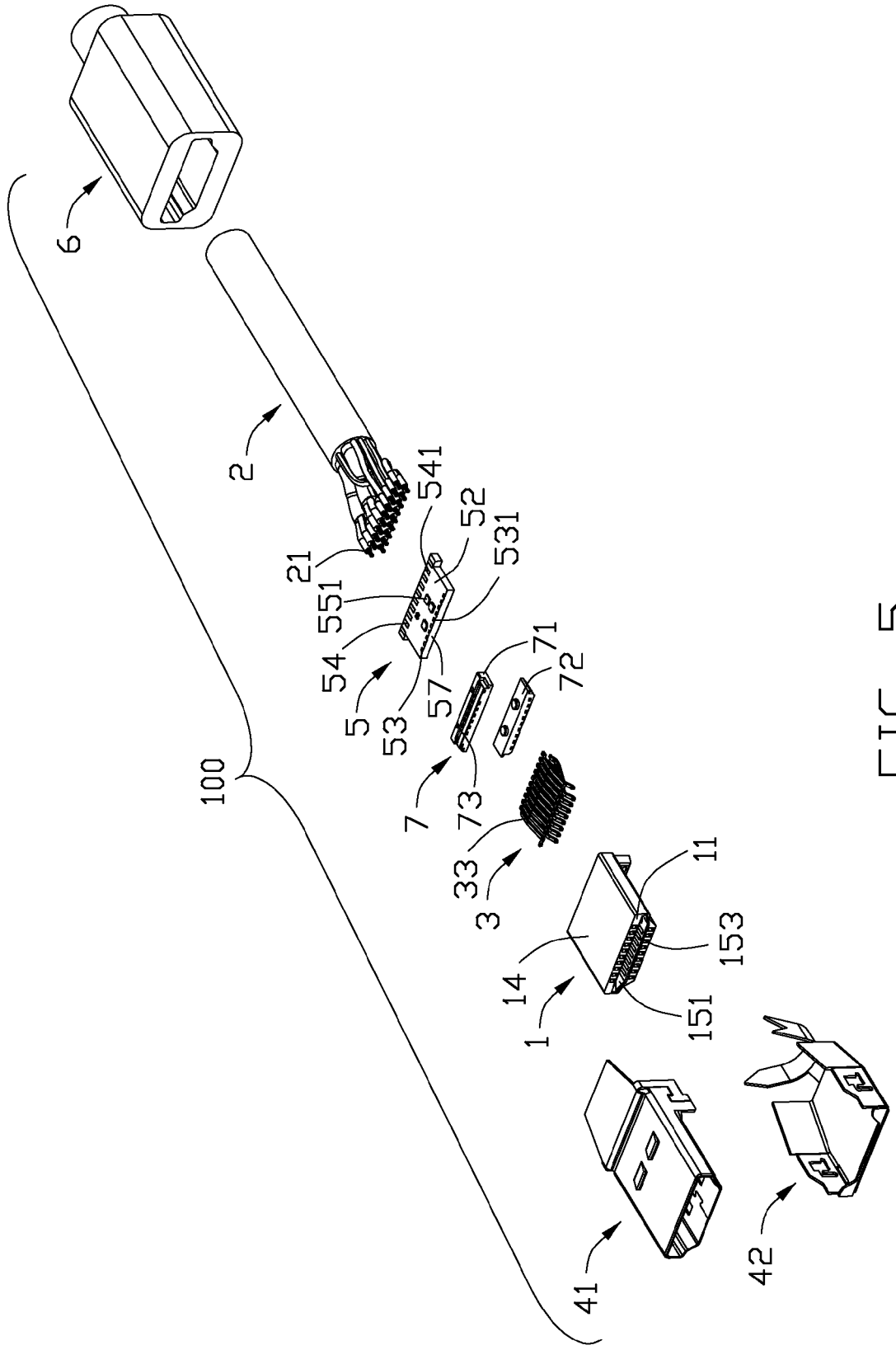

6
2
21
541
52
531
551
54
5
53
57
71
72
7
73
33
3
14
1
11
153
151
41
42
100

FIG. 5

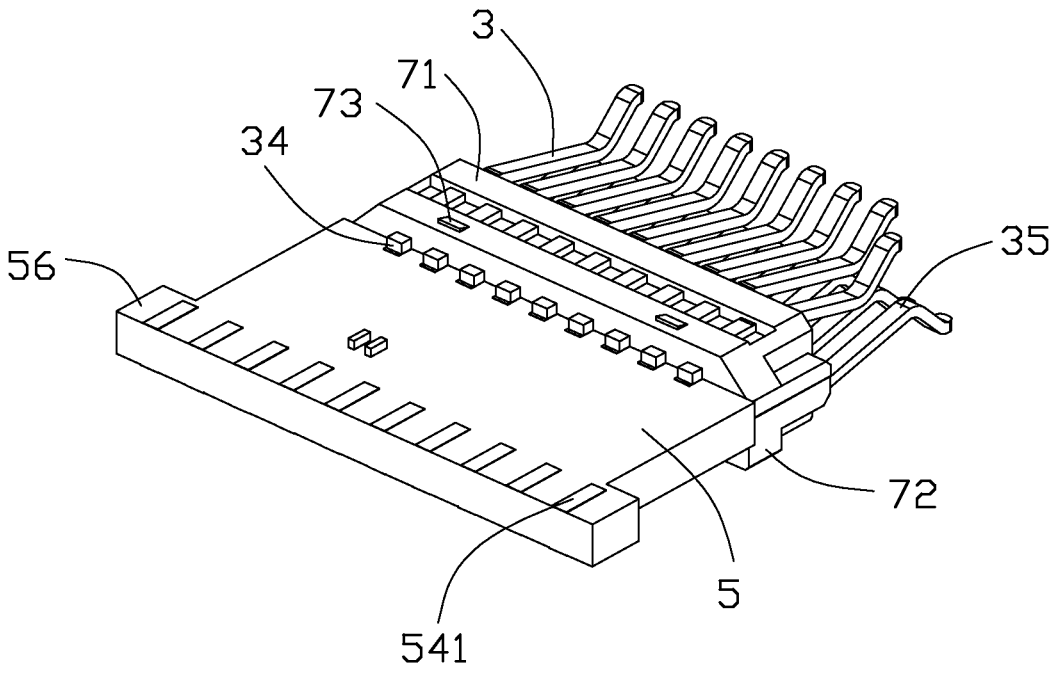


FIG. 6

CABLE CONNECTOR ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a cable connector assembly and an assemble method of the same, and more particularly to a cable connector assembly having an insulative body mated with a printed circuit board.

2. Description of Related Arts

U.S. Pat. No. 6,132,260, issued on Oct. 17, 2000, discloses a cable connector assembly comprising a main housing, a mating member, a plurality of mating contacts and a middle circuit board. Each mating contact comprises a soldering section for engaging with the middle circuit board. The whole mating contacts and the middle circuit board are received in the main housing.

U.S. Pat. No. 7,758,374, issued on Jul. 20, 2010, discloses a cable connector assembly comprising a connector and a cable with a plurality of core wires. The connector comprises an insulative body, a plurality of conductive terminals received in the insulative body, and a printed circuit board electrically connected with the conductive terminals.

U.S. Pat. No. 7,651,379, issued on Jan. 26, 2010, discloses a cable assembly comprising an insulated housing, a contact module, a cable, and a printed circuit board. A plurality of conductive pads are formed on the printed circuit board. The conductive pad extends from a front portion to a rear portion of the printed circuit board, comprising a front end connected with the contact of the contact module, a rear end connected with the cable, and a connecting portion connected between the front portion and the rear portion. The front portion of the printed circuit board is disposed between the contacts extending out of the insulator of the contact module. The rear end of the printed circuit board is exposed out of the insulated housing.

An improved cable connector assembly is desired to offer advantages over the related art.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a cable connector assembly having a printed circuit board mated with an insulative body.

To achieve the above-mentioned object, a cable connector assembly a connector comprises: an insulative body, a plurality of conductive terminals received in the insulative body, and a printed circuit board (PCB) electrically connected with the conductive terminals; a cable having a plurality of core wires; the insulative body comprising a front face and a rear face opposite to the front face, the PCB comprising a front portion electrically connected with the conductive terminals, a rear portion electrically connected with the core wires, and a middle portion connecting the front portion and the rear portion, the rear portion comprising a plurality of first pads electrically connected with the core wires, the front portion and the middle portion being disposed in the insulative body, the rear portion being disposed outside of the insulative body; and a plurality of electronic components disposed on the middle portion.

According to the present invention, the printed circuit board is received in the insulative body in a greatest degree to minimize the length of the cable connector assembly. The design ensures the miniaturization and high performance of the product and saves the space.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a cable connector assembly in accordance with the present invention;

FIG. **2** is a partly exploded view of the cable connector assembly as shown in FIG. **1**;

FIG. **3** is another partly exploded view of the cable connector assembly as shown in FIG. **1**;

FIG. **4** is an exploded view of the cable connector assembly as shown in FIG. **1**;

FIG. **5** is another exploded view of the cable connector assembly as shown in FIG. **1**; and

FIG. **6** is a perspective view of the printed circuit board, the conductive terminals and the spacer of the cable connector assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference will now be made in detail to a preferred embodiment of the present invention.

Referring to FIGS. **1** to **6**, a cable connector assembly **100** comprises a connector **10** and a cable **2** with a plurality of core wires **21**. The connector **10** is an HDMI (High Definition Multimedia Interface) connector. The connector **10** comprises an insulative body **1**, a plurality of conductive terminals **3** received in the insulative body **1**, a metal housing **4** receiving the insulative body **1**, a printed circuit board **5** electrically connected with the conductive terminals **3**, and an insulative housing **6** enclosing a rear end of the metal housing **4** and a front end of the cable **2**.

The insulative body **1** comprises a front face **11**, a rear face **12**, a top wall **13**, a bottom wall **14**, and a receiving space **15** extending through the front face **11** and formed between the top wall **13** and the bottom wall **14**. The receiving space **15** comprises an inserting or mating space **151** on the front of the insulative body **1** for receiving an inserting member, and a mounting or connecting space **152** on the rear of the insulative body **1** for receiving the printed circuit board **5**. A plurality of terminal slots **153** are disposed on an inner surface of the top wall **13** and the bottom wall **14** of the insulative body **1**, respectively. The inserting space **151**, the mounting space **152**, and the terminal slots **153** are communicated to one another. An end of the top wall **13** of the insulative body **1** comprises a pair of lugs **130**. The lugs **130** are disposed symmetrically.

The printed circuit board **5** comprises a first surface **51** and a second surface **52** opposite to the first surface **51**, a front wall **57** and a rear wall **58** opposite to the front wall **57**, a front portion **53** electrically connected with the conductive terminals **3**, a rear portion **54** electrically connected with the core wires **21**, and a middle portion **55** connecting the front portion **53** and the rear portion **54**. A plurality of second pads **531** are disposed on the front portion **53** of the printed circuit board **5** for electrically connected with the conductive terminals **3** and a plurality of first pads **541** are disposed on the rear portion **54** for electrically connected with the core wires **21**. Both of the first and the second surfaces **51**,**52** have the first and the second pads **541**,**531**. A width of the first pad **541** is lager than the width of the second pad **531**. Each first pad **541** is soldered with the corresponding core wire **21**. A pitch between the adjacent second pads **541** is equal to the pitch between the adjacent conductive terminals **3** embedded in the insulative body **1**. The pitch between the adjacent first pads **541** is lager than the pitch between the adjacent second pads **531**. A plurality of electronic components **551** or electric circuits or chips received in the insulative body **1** are disposed on the middle portion **55**. The electronic components **551** or electric circuits or chips could provide the function such as adjusting the impedance and the decoding to expand the function of the connector. A pair of

flanges **56** extend outwardly from the two side of the rear portion **54** of the printed circuit board **5**. The flanges **56** go against the rear face **12** of the insulative body **1** to prevent the printed circuit board **5** from moving into the mounting space **152** of the insulative body **1**. The flanges **56** extend along a horizontal direction.

In this embodiment, the printed circuit board **5** is partly received in the insulative body **1**. Both the front portion **52** and the middle portion **55** are received in the insulative body **1**. The rear portion **54** of the printed circuit board **5** extends out of the insulative body **1** and exposes outside. The front end of the rear portion **54** is flush with the second surface **12** of the insulative body **1**. In this way, the printed circuit board **5** can be received in the insulative body **1** in a greatest degree. Only the portion soldered with core wires **21** is exposed outside to reduce the length of the whole cable connector assembly **100**. The solution solves the limited space when the cable connector assembly **100** mating with the terminal production. The electronic components **551** or electric circuits or chips received in the insulative body **1** can avoid the collision in production process and improve the function of the product, and also can save the cost.

The cable connector assembly **100** further comprises a spacer **7** connected with the conductive terminals **3**. The spacer **7** attaches to the front wall **57** of the printed circuit board **5**. In this embodiment, the spacer **7** is molded integrated with the conductive terminals **3**. And in the other embodiment, the conductive terminals **3** can be assembled with the spacer **7**. The conductive terminals **3** comprise upper conductive terminals **31** and lower conductive terminals **32** arranged in a vertical direction. Each conductive terminal **3** comprises a holding portion **33** held by the spacer **7**, a soldering portion **34** extending rearwardly out of the spacer **7** from the holding portion **33**, and a mating portion **35** extending forwardly and bending from the holding portion **33**. The mating portion **35** is inserted in the mounting space **152** from the rear end to the front end, and extends into the inserting space **151** to mating with the inserting member. The conductive terminals **3** are electrically connected with the printed circuit board **5** by soldering. In this embodiment, the conductive terminals **3** are hotbar or laser soldered with the printed circuit board **5**. In the other embodiment, the conductive terminals **3** also can be electrically connected with the printed circuit board **5** by other means. A holding space (not shown) is formed between the soldering portions **34** of the upper conductive terminals **31** and lower conductive terminals **32**. The front portion **53** of the printed circuit board **5** is partly received in the holding space at least.

The spacer **7** comprises a first spacer **71** connected with the upper conductive terminals **31** and a second spacer **72** connected with the lower conductive terminals **32**. The structure of the first spacer **71** is the same as the structure of the second spacer **72**. A plurality of projections **73** project upwardly from an upper surface of the first and the second spacer **71**,**72** respectively. The projections **73** are used for mating with the inner surface of the insulative body **1** to make the printed circuit board **5** fixed in the insulative body **1** more stable and prevent the printed circuit board **5** and the conductive terminals **3** from retreating from the insulative body **1** after assembling.

The metal housing **4** comprises a first shielding portion **41** and a second shielding portion **42** assembled with the first shielding portion **41** in the vertical direction. The first shielding portion **41** comprises an enclosing portion **411**, a first cover portion **412** with an U-shape, and an extending piece **413** extending rearwardly from the first cover portion **412**. The first cover portion **412** is formed by extending rearwardly from the end of the enclosing portion **411**. The second shielding portion **42** comprises a second cover portion **421** with an U-shape and a cable holding part **422** connected with the second cover portion **421**.

A method of assembling a cable connector assembly **100** is described below. When assembling the cable connector assembly **10**, mold the spacer **7** integrated with the conductive terminals **3** firstly. Solder the conductive terminals **3** which connected with the spacer **7** to the printed circuit board **5**. Then insert the printed circuit board **5** into the insulative body **1** along a back-to-front direction. The printed circuit board **5** is partly received in the insulative body **1**. The conductive terminals **3** are received in the terminal slots **153**. The front portion **53** and the middle portion **55** are received in the mounting space **152** of the insulative body **1**. A plurality of electronic components **551** are disposed on the middle portion **55** and received in the insulative body **1** completely. Solder the core wires **21** of the cable **2** to the rear portion **54** of the printed circuit board **5** to form an electrical connection. Assemble the metal housing **4** out of the insulative body **1**. At last, mold the insulative housing **6** enclosed the rear end of the metal housing **4** and the front end of the cable **2**. In the other embodiment, the printed circuit board **5** also can be soldered with the core wires **21** firstly, and then to be inserted into the insulative body **1**.

Compared to existing technology, the conductive terminals **3** of this invention are shorter than the conductive terminals **3** of other HDMI connectors. In this embodiment, the conductive terminals **3** received in the insulative body **1** occupies the length of the insulative body **1** less than ½. It can guarantee the enough space to receive the front portion **53** and the middle portion **55** of the printed circuit board **5**. The rear portion **54** soldered with the core wires **21** is exposed out of the insulative body **1**. The front end of the rear portion **54** is flush with the second surface **52**. The design reduces the length of the insulative housing **6** and further minimizes the whole length of the connector **10** in an axial direction. The design is convenient to customers for using the cable connector assembly **100** and ensures the miniaturization and high performance of the product and saves the space.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A cable connector assembly comprising:

a tubular insulative housing defining a front mating space and a rear mounting space commonly extending through the housing in a front-to-back direction;

a plurality of contacts disposed in the housing with corresponding contacting sections around the mating space;

a PCB (printed circuit board) defining a front portion, a middle portion and a rear portion in sequence along the front-to-back direction and configured to be only forwardly assembled into the mounting space via a rear face of the housing, tail sections of said contacts mechanically and electrically connected to said front portion, a plurality of electronic components mounted

upon said middle portion, and a plurality of wires with exposed conductors at front ends thereof soldered upon said rear portion; wherein

at least the front portion and the middle portion are both commonly protectively received in the mounting space in a condition that the tail sections of the contacts are pre-assembled to the PCB before both said contacts and said PCB are commonly assembled into the housing via said rear face.

2. The cable connector assembly as claimed in claim **1**, wherein the rear portion is equipped with a stopper to abut against the housing for preventing excessive insertion of the PCB into the mounting space.

3. The cable connector assembly as claimed in claim **1**, wherein said contacts are unified together via an insulative spacer around the corresponding tail sections.

4. The cable connector assembly as claimed in claim **3**, wherein said insulative spacer includes means for retaining to the housing.

5. The cable connector assembly as claimed in claim **3**, wherein said spacer is asymmetric in a vertical direction perpendicular to said front-to-back direction while is symmetric in a transverse direction perpendicular to both said front-to-back direction and said vertical direction so as to have one only orientation for insertion into the mounting space.

6. The cable connector assembly as claimed in claim **3**, wherein the housing defines a plurality of slots around the mating space to receive the corresponding contacts therein, respectively.

7. The cable connector assembly as claimed in claim **1**, wherein the rear portion is exposed outside of the rear face for inspecting soldering between pads of the PCB and the corresponding wires, respectively.

8. The cable connector assembly as claimed in claim **1**, wherein a dimension of a sum of the front portion and the middle portion is around one half of a length of the housing along said front-to-back direction.

9. A method of making an electrical connector, comprising steps of:

providing an insulative housing with a receiving space along a front-to-back direction;

providing a printed circuit board (PCB) with a front portion, a middle portion and a rear portion in sequence along said front-to-back direction;

pre-assembling a plurality of contacts with front mating sections and rear mounting sections to the front portion of the PCB;

providing a plurality of electronic components mounted upon the middle portion;

inserting the pre-assembled contacts and PCB into the receiving space via a rear face of the housing to have both the front portion and the middle portion protectively received in the receiving space without exposure; and

providing a plurality of wires with corresponding conductors mechanically and electrically connected to the rear portion.

10. The method as claimed in claim **9**, wherein the step of pre-assembling comprises unifying the contacts together via an insulative spacer around the mounting sections so as to not only facilitate connection between the mounting sections and the front portion but also facilitate insertion of the contacts into the housing.

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